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# Garden Centipede (*Scutigerella immaculata*): Occurrence Under Varied Treatments and Natural Control

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## ABSTRACT

Abundance / pestal incidence due to symphyllid Scutigerella immaculata in a vegetable garden and clayey soils of buried pots mixed / irrigated with chemical fertilizers of Urea and Diammonium Phosphate (DAP), forest litter, Farm Yard Manure, Poultry Manure and pesticide Nuvan was watched during various seasons. The symphyllid was found to be fairly abundant during warm and moist period of peak vegetable cultivation in the fertile air - dry vegetable garden soils. In common soils of pots pre - treated with varied materials the symphyllid appeared to exhibit varied preference during different seasons. Its incidence was found to be almost similar and moderate in case of pots laden with forest litter and Farm Yard Manure. Repeated tilling, strategic manipulation of irrigation and introduction of centipede Lamycetes sp. could be recommended as some of the manual and natural control methods.

***Key words:*** Symphyliid, Incidence, Vegetable gardens.

## INTRODUCTION

Symphyllids are cryptozoic, whitish, slender and eyeless soil micro-arthropods, with no water proofing wax layer on their cuticle, measuring about 5mm in length. They have diverse feeding habits but species of *Scutigerella* and *Symphyllela* feed on freshly growing roots of plants though in general scutigerellids are known to consume decaying plant and animal matter and thus belong to both herbivore and detrivore component of edaphic food chain. They feed voraciously during inter-moulting periods while during moulting periods feeding is generally suspended.

It was Bacher (1938) who published the first report on the occurrence of the garden symphyllids as pests in English soils. Later on effects of climatic factors on the population of the pest were studied by Edwards (1958). Much attention has not been paid by workers in India on the Pest. Singh and Mukherji (1971) reported *Scutigerella immaculate* from the rose, sugarcane and botanical gardens of Banaras. According to Gessel (1983) garden symphyllids are occasional but very serious pests of most field crops and garden centipede is

another name commonly used for the garden symphyllids and their infestations are widely scattered throughout the common wealth countries. Veeresh (1983) reported *Scutigerella immaculata* as a serious pest in glass houses.

The present survey of vegetable gardens including a pot experiment was carried out to assess the incidence / occurrence of *Scutigerella immaculata* under a variety of treatments.

## MATERIAL AND METHODS

During the middle of each month five $10cm^2$ cut surface (7 - 10cm deep) soil blocks were collected, from a vegetable garden located near Baba demb area of Srinagar in temperate zone and suspected of symphyllid infestation, in a random manner. These soil samples/ blocks, after carefully carrying to the laboratory, were placed in Burlese Tullegren funnels for extraction of *S. immaculata*. The organisms were preserved in 70% alcohol and then counted by using magnifying glass. Besides, to assess the attraction / repulsion of the organisms to materials of varied nature, a pot experiment was performed. For carrying out the pot experiment five liter (15 cm deep) perforated plastic pots were filled with a mixture of soil and materials of varied nature in different proportions. The soil common for all the pots was clay. The variety of materials added in different proportions to different pots included: chemical fertilizers of Urea (0.5 %), DAP or Diammonium Phosphate (0.5 %), pesticide Nuvan (0.25 %), Farm Yard Manure in the form of Cowdung (5 %), forest litter (6.5%) and poultry manure (6.5%) by weight. Nuvan is an organophosphorus stomach, contact and fumigant insecticide. The composition of this insecticide shown on its cover label was: Dichlor (76%), Emulsifier (10. 6%) and solvent (13.4%). Each pot was perforated with 48 holes each of 6mm diameter. The holes in the pots were made by means of 6mm red hot iron rod. Six pots were used for the experiment.

The pots were surface buried in July and then exposed in autumn (September), late autumn (November), winter (January), spring (April) and ensuing summer (July). Following the removal of the pots the organisms were carefully sorted and counted in each individual pot. The organisms, after counting, were restored to the respective pots for seeing their abundance / increase or decrease in their number, if any, at the time of exposures of pots in future.

Soil temperature in the surface stratum of the soil of vegetable garden as well as pots was recorded by simple soil thermometer and moisture content was determined by placing 5g of the both field and pot soil in the hot oven at 85 °C till achievement of its constant weight. The pH of the soil was determined by electrometric method. Organic matter (%) and total nitrogen (%) were determined following Walkley and Black (1934) and Subbiah and Asija (1956) respectively.

## RESULTS AND DISCUSSION

Field survey was carried out from March upto August, as it is in these months that vegetable cultivation is at peak in these gardens and the infestation is reportedly high. During the field survey for the infestation of *Scutigerella immaculata*, the incidence of the organism was found to be positively related to higher soil temperature and moisture content in the hoed organically fairly rich soils (organic matter 7.31 - 23.11%) of the vegetable gardens as depicted in the Table 1.

In the pot experiment the order of preference for different materials by the organism appeared to vary seasonally (Table 2). During early autumn (i.e. September) the abundance of the organisms showed the order: Urea> forest litter>DAP> Farm Yard Manure=Poultry Manure>pesticide. While in late autumn (November) this was DAP> Farm Yard Manure > forest litter > Poultry Manure > pesticide=Urea.

It was also observed that the pots containing pesticide remained least attractive for the organism particularly during the exposures of late autumn, mid – winter (January) and mid – summer (July) and also during mid – summer (July). In winter exposure *S. immaculata* were present in the pots treated with varied materials in the order: Urea > poultry manure > forest litter > Farm Yard Manure > DAP = pesticide. During summer (July) the number of *S. immaculata* attracted was greater in almost all the pots, except the pot laden with pesticide, though with varied preference for materials of different nature and concentration; the order of preference expressed during this period was: Urea > forest litter > Farm Yard Manure >DAP > poultry manure > pesticide.

Veeresh (1983) reported symphyllids more commonly inhabiting soils rich in organic matter and retaining moisture in higher amounts. During this study *S .immaculata* appeared to prefer slightly alkaline soils. The soils of the vegetable garden showed pH 7.50 and 7.81 in the range of mildly alkaline and slightly alkaline as per the categorization of Raychaudhuri (1966). Soil temperature in the range of about 20 °C and 27 °C with moisture content of 30 % and 40 % also appeared to have positive impact on the incidence / occurrence of the organism (Table 1) as the population was towards higher side during summer when the temperature was higher and the organisms also appeared to move towards the surface stratum in late spring and summer. Similar observations stand recorded by Mir (1986). By visual field observations it was seen that the organism was multivoltine and most probably its multiplication was determined by microclimate i. e. wherever and whenever the favourable conditions prevailed in their habitat the population began to reproduce. The young ones were identical to adults but only smaller in size. About seven instars are already known to be completed in very short spans of time by the organism in its life cycle Vereesh (1983).

In pots the over all population of *S. immaculata* appeared to have a positive relation with the organic matter content as is revealed from their continuous occurrence in pots containing organic matter in the form of such materials as forest litter, Farm Yard Manure and poultry manure. In case

**Table 1. Incidence of *Scutigerella immaculate* in surface stratum of soil (7–10 cm deep) of the vegetable garden with some soil parameters.**

| MONTH | PARAMETERS | | | | | | |
|---|---|---|---|---|---|---|---|
| | Surface soil temperature (°C) | Soil moisture content (%) | pH | Organic Matter (%) | Total Nitrogen (%) | *Scutigerella immaculata* (%) | Average density / m² |
| March | 13 | 32.50 | 7.54 | 23.11 | 0.050 | 8.63 | 2060 |
| April | 17 | 29.66 | 7.74 | 21.37 | 0.046 | 11.44 | 2732 |
| May | 20 | 43.95 | 7.79 | 14.79 | 0.032 | 17.64 | 4211 |
| June | 23 | 29.18 | 7.60 | 9.59 | 0.020 | 23.59 | 5632 |
| July | 27 | 33.33 | 7.81 | 7.39 | 0.016 | 30.25 | 7221 |
| August | 29 | 26.21 | 7.50 | 7.31 | 0.015 | 8.42 | 2010 |

of pots laden with chemical fertilizers of DAP and Urea the organism showed a discontinuous occurrence and also the upper number of the range was fairly high (Table 3). Forest litter probably being a natural material contained moderate numbers of the organism. Farm Yard Manure and Poultry Manure probably being semi-natural also remained attractive for the organism as these contained organic matter in quite a fair amount. The upper range in the number of organisms in case of the pot laden with Poultry Manure was also fairly high (7.14%) even as compared to 4.36% in case of Farm Yard Manure. Organic matter content in case of Urea, Poultry Manure and Farm Yard Manure although almost similar yet in case of the pot laden with Urea the upper number in the range of occurrence of the organism was fairly higher while at times the organism no more shows its presence. Similarly in case of DAP also the situation was almost similar i.e. at the lower side of the range the organisms were absent while at the upper side the occurrence was fairly high (11.00). In case of the pot laden with pesticide the occurrence of the organism was almost insignificant. Though it is an undeniable fact that the use of pesticides and chemical fertilizers has become an integral part of the modern agriculture and these constitute important inputs into soil in addition to seed and water. These materials applied in whatever form either above ground level or into the soil ecosystem do likely contaminate and leave residues in soil, which affect soil biota in many ways.

In the pots also in the month of July, *S. immaculata* were higher in number than in the other months it may be because of the fact that almost all the pots were found to be encroached upon / penetrated through their holes by soft and tender roots of the surrounding plants. Rao (1959) also observed higher number of symphyllids during summer, feeding and damaging roots and rootlets of

**Table 2 : *Scutigerella immaculata* % in variously treated pots filled with clay soil as the common basic material**

| Treatment | Early Autumn | | | | | | Late Autumn | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Common Soil+ | Soil Temp °C | Moisture % | pH | Org. Matter % | Total N % | S. Immaculata % | Soil Temp °C | Moisture % | pH | Org. Matter % | Total N % | S. Immaculata % |
| Urea | 19.0 | 23.0 | 7.67 | 0.89 | 0.026 | 5.10 | 9.0 | 28.7 | 7.11 | 0.74 | 0.021 | 0.00 |
| Forest Litter | 20.0 | 23.9 | 7.29 | 0.84 | 0.024 | 4.12 | 9.2 | 25.0 | 7.48 | 0.74 | 0.021 | 3.00 |
| DAP* | 19.0 | 23.3 | 6.92 | .75 | 0.022 | 3.15 | 9.0 | 24.0 | 7.59 | 0.65 | 0.019 | 11.00 |
| Cowdung FYM | 19.5 | 27.2 | 7.54 | 1.01 | 0.029 | 2.62 | 9.4 | 26.4 | 7.24 | 2.59 | 0.075 | 4.00 |
| Poultary manure | 19.2 | 23.9 | 7.42 | 0.72 | 0.021 | 2.52 | 9.4 | 28.6 | 7.08 | 1.23 | 0.023 | 1.80 |
| Pesticide** | 19.0 | 24.0 | 7.29 | 0.89 | 0.021 | 0.06 | 9.0 | 26.4 | 7.48 | 0.75 | 0.022 | 0.00 |

| Mid-Winter | | | | | | Mid-Spring | | | | | | Mid-Summer | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Soil Temp °C | Moisture % | pH | Org. Matter % | Total N % | S. Immaculata % | Soil Temp °C | Moisture % | pH | Org. Matter % | Total N % | S. Immaculata % | Soil Temp °C | Moisture % | pH | Org. Matter % | Total N % | S. Immaculata % |
| 1.0 | 27.6 | 7.46 | 0.70 | 0.020 | 8.56 | 15.00 | 27.00 | 7.70 | 0.72 | 0.023 | 5.07 | 21.0 | 25.0 | 7.70 | 0.77 | NA | 5.24 |
| 1.5 | 27.1 | 7.63 | 0.92 | 0.027 | 4.28 | 17.00 | 28.00 | 7.65 | 0.90 | 0.024 | 3.72 | 21.5 | 21.5 | 7.67 | 0.86 | NA | 4.66 |
| 1.0 | 27.9 | 6.82 | 0.72 | 0.021 | 0.00 | 15.00 | 27.00 | 7.80 | 0.68 | 0.020 | 2.26 | 21.2 | 22.7 | 7.34 | 0.68 | NA | 4.21 |
| 1.3 | 30.3 | 7.23 | 1.80 | 0.052 | 3.96 | 17.00 | 30.00 | 7.44 | 2.20 | 0.042 | 1.28 | 22.0 | 24.2 | 7.66 | 2.06 | NA | 4.36 |
| 1.0 | 29.8 | 7.40 | 0.89 | 0.026 | 7.14 | 15.00 | 27.00 | 7.50 | 0.84 | 0.025 | 1.39 | 21.4 | 22.5 | 7.63 | 0.68 | NA | 1.44 |
| 1.0 | 28.9 | 7.29 | 0.70 | 0.020 | 0.00 | 15.00 | 27.00 | 7.45 | 0.73 | 0.021 | 0.05 | 21.0 | 25.0 | 7.39 | 0.68 | NA | 0.00 |

* DAP (Diammonium phosphate)
NA = Not available

** Nuvan, an organophosphorus stomach, contact and fumigant insecticide.

**Table 3. Incidence of *Scutegerella immaculata* in variously treated surface buried pots laden with soil of common origin.**

| S. No | Material (Common soil +) | pH range | Organic matter % range | Occurrence of *Scutegerella immaculata* % |
|---|---|---|---|---|
| 1. | Urea | 7. 11 and 7. 70 | 0. 70 and 0. 89 | 0.00 and 8. 56 |
| 2. | Forest litter | 7. 29 and 7. 67 | 0. 73 and 0. 92 | 3. 00 and 4. 66 |
| 3. | DAP* | 6. 82 and 7. 80 | 0. 65 and 0. 75 | 0. 00 and 11. 00 |
| 4. | FYM* | 7. 23 and 7. 66 | 1. 01 and 2. 59 | 1. 28 and 4. 36 |
| 5. | P M* | 7. 08 and 7. 63 | 0. 72 and 0. 89 | 1. 31 and 7. 14 |
| 6. | Pesticide* | 7. 29 and 7. 48 | 0. 68 and 0. 89 | 0. 00 and 0. 06 |

*DAP= Diammonium phosphate
*FYM= Farm yard manure or Cowdung
*PM= Poultry manure which is generally Uric acid in bulk with undecomposed litter of saw dust
*Pesticide= Nuvan

young sugar cane cultivars and causing 30 - 40% plant mortality. In field surveys also an increasing trend in the average number of symphyllids was recorded when, besides high temperature and moisture content, the vegetation cultivation was at its peak and soft and tender roots were available for the organism to feed upon.

The overall picture with regard to the occurrence / incidence of *S. immaculata* in variously treated pots and as depicted in Table 2. was: the organisms exhibited almost constant or identical degree of occurrence in case of the pots mixed with forest litter through various seasons. Almost similar incidence was found to be expressed by the organism in case of the pot laden with Farm Yard Manure (Cowdung) in which the amount of the organic matter (%) was found to be in the range of 1. 01 and 2. 59 and the total Nitrogen in the range of 0.029 % and 0.075 %. The range of total Nitrogen in case of the pot laden with forest litter was between 0.021 % and 0.027 %. Occurrence of the organism in case of the pot pretreated with pesticide was very little. While it is already known that the effects due to pesticides and other synthetic materials added to soils on the mesofauna are complex because of their action on both predaceous and non – predaceous groups. Several workers have reported increased population of Collembola and mites after the use of pesticides, mainly because of mortality among the predaceous mites which exercise a great check on other mites and collembolans. All nematicides and most of the carbamates kill symphyllids (Edwards, et al., 1967).

The vegetable cultivators in the valley, besides treating the soils of their gardens with pesticides like Gamaxene, Carbaryl, Nuvan etc.,were also found adding common salt against the organism but in this study impact of treatment of common salt was not taken into consideration. The addition of common salt in an unprescribed manner needs further monitoring.

Repeated tilling of the soil prior to transplantation of vegetable seedlings or seeds so that soil loses moisture to some degree is a probable physical preventive measure for the pest. Strategic manipulation of irrigation in the vegetable gardens can also help in preventing their infestation. A soil dwelling cryptozoic chilopod *Lamycetes* sp. was seen as predators of the *S. immaculata*. Introduction of this predator in large numbers in the infested vegetable gardens could probably be helpful in reducing the infestation.

## REFERENCES

Bacher, M. 1938. The biology of the garden centipede *Scutigerella immaculata*. *Hilgardia* **11**: 1 – 148.

Edwards, C. A. 1958. The Ecology of Symphyla 1. *Population Ent. Exp. App.* **1**: 308 – 319.

Edwards, C. A. ; Thompson, A. R. and Lofty, J. R. 1967. Changes in soil invertebrate population caused by some organophosphate insecticides. *Proceedings 4th British insecticides, fungicides conference* **1**: 48 – 55.

Gessel, S. 1983. *Garden symphyllan as a Pest of Field Crops*. Pennsylvanian State Entomology Deptt. Fact Sheet.

Mir, G. M. 1986. *Bioecological studies of soil of coniferous forest ranges of Kashmir valley*. Ph. D. thesis, University of Kashmir, Srinagar.

Rao, G. N. 1959. The occurrence of Symphylid (class Myriapoda) as a pest of Sugarcane at Coimbatore. *Curr. Sci.* **28** (4) : 170.

Raychaudhuri, S. P. 1966. *Land and Soil*. National Book trust of India, New Delhi

Singh, J. and Mukherji, S. P. 1971. Quantitative composition of soil micro-arthropods in some fields at Varansi (India). *Oriental Insects*. **5**: 487 – 494.

Subbiah, B. V. and Asija, G. I. 1956. A rapid procedure for the estimation of available Nitrogen in soils. *Curr. Sci.* **25**: 259 – 260.

Veeresh, G. K. 1983. Microarthropods. In : *Applied soil Biology and Ecology*. (G.K. Veeresh and D. Rajgopal, eds.) Oxford and IBH Pub. Comp. Pvt. Ltd. New Delhi.

Walkley, A. and Black, I. A. 1934. An examination of the Degtjareff method for determining soil organic matter and a proposed modification of the chromic acid titration method. *Soil Science*. **34**: 29 – 38.